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Marcel Pawlowski (UCI): Phase-space structures in satellite galaxy systems

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Our ever-increasing observational knowledge of satellite galaxy systems now allows us to identify structures in the phase-space distribution of satellites belonging to a common host, by studying their distribution and motion. This can potentially reveal connections in the formation and evolution history of different satellite galaxies, but can also be used to test cosmological models. One example of a recently discovered type of structure is that satellite galaxy systems around pairs of host galaxies are lopsided towards their partner host, a phenomenon that appears consistent with cosmological simulations based on the ΛCDM paradigm. A different type of structure are kinematically correlated Planes of Satellite Galaxies. Observations of the distribution and motion of satellites around the Milky Way and the Andromeda Galaxy have revealed the existence of such satellite galaxy planes, and evidence for similar structures beyond the Local Group is accumulating. Correlations as extreme as the observed ones are very rare in cosmological simulations based on the ΛCDM model. In contrast to other small-scale problems, current cosmological simulations provide no evidence that modeling baryonic physics or different types of dark matter alleviates this problem, because they do not substantially enhanced phase-space correlations among satellite galaxy systems. Unless a solution is found, the mismatch between the observed satellite galaxy planes and model expectations thus poses problems not just for the specific cold dark matter model, but potentially for the dark matter hypothesis in general.

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